

**INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION  
IN THE FLORICULTURAL FARMS IN KENYA**

**BY**

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## **DECLARATION**

This research project is my original work and has not been presented for an award in any other university.

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## **DEDICATION**

This work is dedicated to my family whose enduring tolerance, forbearance and support has seen my academic dream come true as well as the Real IPM Company Kenya limited management whose support and encouragement was beyond measure.

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## ACRONYMS AND ABBREVIATIONS

<b>CAS</b>	Complex Adaptive Systems
<b>DTIS</b>	Diagnostic Trade Integration Study
<b>EFITA</b>	European Federation for Information Technology in Agriculture
<b>EPC</b>	Exports Promotion Council
<b>GFAR</b>	Global Forum on Agricultural Research
<b>HCDA</b>	Horticultural Crops Development Authority
<b>ICTs</b>	Information and Communication Technologies
<b>KFC</b>	Kenya Flower Council
<b>NAPE</b>	National Association of Professional Environment
<b>QRC</b>	Quick Response Code
<b>SLA</b>	Service Level Agreement

## **ABSTRACT**

ICTs have been introduced in the agriculture and food sectors, improving production as well as transportation of agricultural products to the end consumers. The uptake of these solutions has however been slow for various reasons. A key challenge for ICT in various sectors such as agriculture has been information management, both within specific domains and across the whole supply chain from farm to fork, a factor further compounded by specific characteristics of the agricultural sector, which includes the very large number of actors along the supply-chain and the heterogeneity of those actors. The study sought to establish information technology adoption in the horticultural firms in Kenya with the objectives as; to determine the extent of ICT adoption by floricultural farms in Kenya, to establish the drivers of ICTs adoption by the floricultural farms in Kenya and to establish the challenges of ICTs adoption by the floricultural farms in Kenya.

The study surveyed the floricultural farm managers. It employed a cross sectional descriptive survey design; targeting 45 managers from each of the 45 sampled horticultural firms. Primary data were collected using questionnaires, analysed using percentages, frequencies, mean, standard deviation and regression analysis and results presented using figures and tables. It established that computer storage and servers, internet and emails, Office, procurement and accounting automation systems such as sage pastel, Dan soft, Dynamics Navision and computerized irrigation and fertigation systems as examples of ICT applications had been adopted in the floricultural farms.

Lastly, the study established that other than technical, economic, functional and strategic drivers that were studied, other factors also play a role in ICT adoption as represented by the adjusted  $R^2$ . This therefore means that other factors not studied in this research inform ICT adoption. Therefore, further research should be conducted to investigate those other drivers of the ICT adoption.

## **CHAPTER ONE: INTRODUCTION**

### **1.1 Background**

Over the past few decades, ICTs have been introduced in the agriculture and food sectors, improving production as well as transportation of agricultural products to the end consumers. The uptake of these solutions has however been slow for various reasons. A key challenge for ICT in various sectors such as agriculture has been information management, both within specific domains and across the whole supply chain from farm to fork, a factor further compounded by specific characteristics of the agricultural sector, which includes the very large number of actors along the supply-chain and the heterogeneity of those actors. The consequent is very poor information flow along the supply chain (World Bank Group, 2012).

In business, ICTs have a potential to contribute to achieving significant and sustainable economic, social and environmental benefits (GFAR, 2012). Syed, (2009) supports this and indeed notes that business survival will increasingly be informed by ICT applications whose adoption is therefore inevitable. With regard to agriculture, he notes that ICTs are rapidly influencing global agricultural production and consumption patterns. He therefore suggests that every industry must accelerate its rate of ICTs adoption if it is to increase its global competitiveness. Adoption and application of ICTs in the businesses, more so in floriculture, farms, have also been suggested as an important strategy according to studies by Heratha *et al* (2004) with drivers to the same being categorized as economic, functional, technical or strategic.

In 8 out of 25 farmers according to EFITA conference held in 2007 in Glasgow, the percentage of computerized farm operations were recorded as below 10%, while budget allocation to ICTs were less than 1% of the total organizational budget. After data analysis collected using the EFITA Questionnaire titled *ICT Adoption Trends in Agriculture*, fear of confidentiality loss, lack of a clear strategy on ICTs adoption in the farms, possible impacts on work practices, lack of security and proper SLAs, huge costs associated with ICTs deployment, maturity levels of the farms as well as the culture of different farms were cited as major challenges towards ICTs adoption (EFITA, 2007).

In the Kenyan context, HCDA (2013) reckon that to make Kenya's floriculture farms truly globally competitive, ICTs adoption will significantly help especially through cost savings and efficiency improvements. However at a global level, studies by Martsynovska, (2011), Taragola and Gelb (2011) as well as Maoz (2006), conclude that researches on the extent of adoption of ICTs in the global floriculture industry are scarce. In the few countries especially in Europe where such researches have been done, they focused mainly on basic computer application for general agricultural production as noted during EFITA participants' perspectives (Taragola & Gelb, 2011).

In floricultural organizations, ICTs can be applied in many areas. A pointer to this is a DTIS that was conducted in Tanzania by the World Bank and aiming to identify Tanzania's internal and external agricultural key trade constraints, and with a focus on how trade expansion could improve agriculture. Management of often huge pack-house data in a way that ensures knowledge accumulation that can often be drawn from, as well as automatic generation of planting and spray programmes were identified as potential areas of ICTs intervention (Sergeant, 2004). Other potential areas of ICTs application and which are agriculture specific include traceability, consumer safety, food safety and processing value chains. For example in China according to an article published in the *Global Times*, Pudong Agriculture Association labels a popular variety of locally grown watermelon with QR codes. When consumers scan the QR sticker with a cellphone, the QR links to a website where the consumer can access the fruit's planting date, how much fertilizer was used, the date it was picked and contact information for the Pudong Agriculture Association (Qian, 2013). These are potential areas of ICTs intervention in the Kenyan floriculture industry.

### **1.1.1 ICT and Adoption**

Adoption can conventionally be taken to mean the decision or choice to acquire and/or use a concept or an object (Hall & Khan, 2002). Rogers (1995) on the other hand defines adoption as making full use of a new idea as the best course of action available. This paper made use of this definition as it appeared explicitly or implicitly used by many adoption analysts and therefore widely accepted. Maumbe and Okello (2010), note that although developed countries have in the

past two decades led the world in ICTs use, this past decade has seen exceptional growth in ICTs usage by developing countries. In general, developing countries are now boasting of the fastest growth in ICT penetration and related productivity growth and adoption of ICTs in the developing countries has indeed surpassed that of developed and transition countries.

However in the last several decades, adoption and implementation of ICTs in organizations has often been costly, frustrating and with a relative low success rate. Specifically, fear of loss data and information confidentiality, lack of clear ICT strategies among organizations, impacts on work practices and organizational culture are key limitations of ICT adoption (Mojtahed, Miguel & Guo, 2011). Despite this, Mojtahehd *et al*, ( 2011) note that more and more organizations still continue to invest in ICTs aiming to improve their performance, maintain and increase customer satisfaction, increase the quality of their products and services and maintain costs at minimum.

In different businesses such as floricultural farms, Herath, Zoysa and Karunanananda (2004), identified the need to gain knowledge especially in the very dynamic nature of the floriculture sector, acquire global market information and in real time, higher profits due to improved decision making and production process optimization as some of the major drivers of ICTs adoption in Srilanka's floriculture farms. Separately, Silva and Ratnadiwakara, (2010) in their research on levels of ICT adoption in Sri Lanka's agricultural sector conclude that the current ICT revolution is making previously costly global market information as well as operations decisions that enhance global production and operation standards much more affordable particularly to floriculturists. The two studies therefore conclude that if used appropriately, ICTs could potentially reduce the high cost of agricultural related research, production, processing and operation transactions costs associated with the floriculture farms thereby making a country's flowers and other products more competitive and the industry in general more profitable and prepared for future eventualities.

Given that the objective of ICT in businesses is to act as an enabler and aimed at reducing research, production, processing, operation and transaction costs for businesses, Silva and Ratnadiwakara (2010) conclude that it is imperative that transactions costs are understood and well defined. They suggest that markets observable transaction costs would include tangible (and

proportional) costs notably transport, handling, packaging, storage, spoilage and other costs that are visible when an economic exchange takes place, and could potentially be reduced through use of ICT applications.

Although some researches point out cost of ICTs deployment the biggest limitation to ICTs adoption which is often coupled with inability to quantify ICT benefits, there is consensus among many researches that costs minimize profitability and a big portion of such costs could potentially be reduced through adoption of ICTs (Maumbe & Okello, 2010). Whether informed by ICTs productivity paradox as illustrated by Marianna (2003) in her work that concluded that researches have not persuasively established any significant relationship between ICTs adoption and productivity, differing factors drive ICTs adoption in the Kenyan floricultural farms (Taragola & Gelb, 2011). In conclusion, many researches seem to concur that drivers of ICTs adoption fall in either economic, functional, technical or even strategic categories.

### **1.1.2 Floriculture Industry in Kenya**

Kenya's flower industry is the largest and oldest in Africa and the story of the industry is considered an economic success story (Mekonnen, Hoekstra and Becht, 2012). Having begun in the 1960s, Kenya is today a major flower producing country on the international market (Hortiwise, 2012). She has for a period of over twenty years been a dominant actor and exporter of flowers to the European market and during this period, the country has had an annually growth rate of 13 % in flower production (Ridsellius, 2011).

In the development front, the industry is currently ranked as one of the country's fastest growing sectors, specifically ranked second largest foreign exchange earner after tea according to EPC (2014). In a separate report from the World Bank Group (2011) titled "*The Global competitiveness of the Kenyan Floriculture industry*", World Bank notes that the global leading flower exporters are the Netherlands, Ecuador, Kenya and with Ethiopia fast joining in respectively. Though the report further notes that the industry continues to expand, it predicts that in future, it is expected that ICT developments and ever stricter requirements for suppliers will increasingly influence the industry's profitability.

On ICTs adoption, World Bank Group (2012) notes that little research has been carried out on the uses and levels of adoption of ICTs in Kenya's agriculture as a general subject. Further, it notes that because the use of ICTs to tackle rural development and agriculture related challenges is so new and constantly changing in nature, the amount of research done on the impacts and outcomes of programs and technologies still remains limited. However, it is important to note that research at a global level has been carried out on such areas as ICTs for climate change adaption, but World Bank Group (2012) regrets that knowledge about how ICTs can reduce climate-related vulnerabilities is not widespread, in turn limiting ICT's possible interventions on the same. Since floriculture is mainly carried out in green houses where most environmental conditions are controlled, of interest to Kenyan floriculturists would be the economic, functional, technical and strategic factors that would enhance global competitiveness of the Kenyan flower stems.

Typically, the operations in any floricultural or horticultural organization can be divided predominantly into three stages namely production activities, harvesting activities and post harvest activities according to Magana flowers, a flower farm located in Kikuyu at the outskirts of Nairobi. Production activities mainly occur in the green houses, requiring monitoring of environmental conditions, watering and fertigation. Harvesting activities mainly entail the transition of the mature product from the green houses to the pack-house in a manner that guarantees the quality required by the market and with perish-ability of the product on mind. Lastly, post harvest activities entail sorting, grading, packaging and eventual transportation to the market (Magana-Flowers, 2011).

In all the three stages, ICT applications can be used as is the case in the Netherlands according to Badgery (2011) where computerisation has been achieved in activities such computerized irrigation systems with automated daily watering, with special nozzles fitted to ensure uniform watering, computerized climate control with greenhouses fitted with sensors that send messages to a centralized computer system thereby opening and closing the greenhouse vents depending on the environmental condition. Others include automatic temperature regulating cold rooms, grading halls, computerised reservoirs and spraying equipment as well as automated and refrigerated transportation. Mobile devices such as phones and tablets could also be useful in

areas such as paying workers through mobile money transfer services as well as scarab systems which growers can use to view time series of maps and compare spatial distributions of specific pests or diseases over time within individual green houses.

In conclusion, many researches such as EPC (2014), HCDA ( 2013) and Awour (2012) reckon that there is need to optimise operations and value addition processes in the Kenyan floricultural farms from end to end both horizontally and vertically. The three also agree that there is a research gap on what the current situation on ICTs adoption in floriculture farms is, what ICTs adoption challenges are and what needs to be done inorder to optimise operations and value addition, more so in the developing economies like Kenya and hence the need for this study.

## **1.2 Research Problem**

Despite the growing number of studies on the adoption of ICTs in agriculture, the literature available still suggests the need for advancing understanding of the key factors experienced in different contexts. EFITA (2007) notes that it would be useful to have an evaluation of the existing software programs relevant to flower farms in order to evaluate their compatibility with perceived needs and shortcomings, and hence their adoption. Though World Bank (2012) applauds the current lucrative position of the Kenyan floriculture sector in the world market, it notes that measures need to be taken to ensure sustainability of the industry's foreseeable future according to Kangogo *et al* (2013). The floriculture industry is a perfect example of a complex adaptive environment and therefore players in the industry require complex adaptive systems to survive according to Awuor (2012). However according to World Bank (2012), data and information processing, packhouse operations as well as field operations in many Kenyan flower farms as an example exhibit inadequate capability and capacity to consistently match supply with demand over the long term notwithstanding the prevailing productivity momentum. The World Bank Group (2011), also reckons that many flower farms lack the necessary ICT strategies to not only ensure consistency and stability in production, but also to ensure continuous process improvement through efficiency and effectiveness that is geared towards ensuring continued competitiveness.

According to Kagongo *et al* (2013), Kenyan floriculture farms continue to suffer from costly discontinuities in the current rapid markets and vastly-changing technological world. Indeed Awour (2012) agrees with this, noting that Kenyan flower farms' work flow systems are inflexible and susceptible to disruption as they are unable to swiftly and adequately respond to emerging international protocol, certification requirements, and to the various governmental and regulatory changes, precisely due to low levels of ICTs that would optimise operations and value addition processes from end to end. ICTs have introduced what is known as the 'Networked economy', where successful businesses are linked with their suppliers, internal production processes, shippers and customers in real-time.

Businesses are now able to move data and communicate with stakeholders in real time, transforming the way transactions are being done. While ICTs have the capacity to cut costs associated with farm operations coordination, communication, production and information processing, and with many businesses in other sectors having taken advantage of this, technology informed floricultural practises have not been achieved in many flower farms in Kenya according to KFC (2014). This study therefore sought to investigate the extent, the drivers and challenges of ICTs adoption in the floricultural farms in Kenya.

### **1.3 Research Objectives**

The research objectives were;

- i. To determine the extent of ICT and ICT tools adoption by floricultural farms in Kenya
- ii. To establish the drivers of ICTs adoption by the floricultural farms in Kenya
- iii. To establish the challenges that limit adoption of ICTs by floricultural farms in Kenya.

### **1.4 Value of the Study**

The research will firstly establish what the current levels of ICTs adoption in the flower farms in Kenya are in comparison with the world floriculture leaders such as the Netherlands. It will therefore be useful to the farm managers and decision makers in the farms in identifying possible

areas of ICTs intervention and the need to invest more resources in ICTs in order to remain profitable and therefore globally competitive.

Secondly, the research will also be of importance to flower farms ICT and technical staff who will be better informed and better placed to advise key decision makers such as farm managers of the need to invest, and in appropriate ICT tools that could help in promoting effectiveness and efficiency in operations, increase productivity while cutting on costs and therefore giving farms a competitive edge.

Lastly, the research will also be useful to the government of Kenya. Noting that floriculture contributes over 4% of Kenya's GDP according to EPC (2014), the government would be interested in identifying the challenges hindering ICTs adoption for purposes of policy formulation. Government policy makers, informed by the results of this study would be better placed in making decisions such as on whether to waive taxes on any ICT infrastructure and tools that are destined to the floriculture sector. In so doing, the Kenyan government could help the sector remain globally competitive in days to come.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter presents a review of available literature on the extent of ICTs and ICT related tools adoption, the various drivers of ICTs adoption as well as well as the limiting factors to ICTs adoption among flower farms in Kenya. The chapter will also provide the theoretical framework of the study.

### **2.2 The Value of ICTs**

Though Netherlands continues to play a key role in the international flower trade, Kenya could take advantage of various ICTs to ensure continued competitiveness. ICTs, according to a study on Technology and Green house horticulture ensures 15-20 times more production per unit area, while water usage is 80% less. The study concluded that ICTs intervention has the potential to improve productivity by over 30%, translating to approximately 27% return on investment where the green house is more than 2 hectares (Badgery-Parker, 2011).

### **2.3 ICT in Agriculture**

Kenyan companies have long benefited from a strong Euro, making their costs in Kenyan shillings and US dollars relatively low. Labour and energy costs are low while operations costs continue to go up. Kenyans still pay no import duty when exporting to Europe (Rikken, 2011). Economic indicators show a steady rise in the importance of the flower industry to the Kenyan economy as noted elsewhere in this paper. However, without the necessary incentives and investment in technology, the benefits are likely to be skewed towards the developed countries as opposed to developing countries (Leipold and Morgante, 2011). Though the Kenyan flower industry represents a rich and well-established contribution to the Kenyan economy according to Riddsellius (2011), the sustainability will greatly depend on investment in technology. This is inevitably the future.

According to Awour (2012), Kenya's floriculture industry has a steady 10-20% annual increase in production, exports and foreign exchange earnings. Further, Awour notes that the private sector has greatly contributed to this as most flower farms are privately owned while the

government has provided structural macroeconomic reforms including a well liberalized trading environment. However, challenges such as poor infrastructure, the perishable nature of flower stems therefore requiring an expedited processing systems that can often be achieved with use of ICTs, as well as aggressive external market competition coupled with strict regulations continue to be major concerns in the Kenyan horticultural industry (HCDA, 2013).

Some of the reasons, according to Awour (2012) and HCDA (2013) why Kenya continues to be a top producer of flowers are firstly, because the climate is ideal for flower production and greatly favors so. This is scientifically because the light levels at the equator region where Kenya lies are optimally maximized and the high altitude naturally regulates temperatures from exceeding the optimum levels for temperate crops. Having the sun directly overhead naturally promotes production of straight high quality stems. Secondly, Kenya affords some sufficient good quality water coupled with highly educated and trained work force at competitive wage levels. Lastly, Awour, (2012) notes that availability of airfreight with Kenya being a “hub” for the airline industry in the East African region provides the crucial cargo capacity need.

HCDA (2013) adds that the government’s deliberate move to liberalize the economy over the years and the consequent removal of exchange control and related constraints have also played a critical role in accelerating the growth of the floriculture industry. According to HCDA (2013), the Kenyan government facilitates and promotes trade through proving incentives that take the forms of zero or subsidized duties and other taxes on agricultural inputs that are crucial to the sector such greenhouses and greenhouse covers, refrigeration equipment and cold stores required for cooled storage, dam construction lining, shade nets and other related items. However, this body notes that more could still be done especially in automating farm practices.

As a result of the efforts from both the private sector and the Kenyan government, there are over 900 active exporters of cut-flowers while the total capital investment is more than USD 1 billion (HCDA, 2013). The total area under floriculture is estimated at close to 8000 hectares (KFC, 2014) as pointed out earlier with cut roses dominating the export markets. This places great emphasis on the selection of varieties, as according to Awour, (2012), the market follows a certain distinct trend. HCDA (2013) and Awour (2012) agree that flower bouquets continue to

be in high demand and the trend has been towards adding value through bouquets and shipped ready for supermarket. The two researches reckon that Kenya supplies about 40% of cut-flowers and bouquets to the world fresh flower market. Out of this, around 97% is exported to the European Union, whose consumption stands at around 50% of the world flowers (KFC, 2014) giving the sector a high economic value.

In evaluating individual choices with regards to technology adoption, most of the literature on technology adoption seems to generally focus on three sets of determinants: adopters' characteristics, features of the competitive environment, and attributes of the technology. Among adopters' characteristics, farm size, budget allocation, age, and capabilities are usually considered among the main determinants. The competitive environment can in this case be described by the degree of farms concentration, the level of prices, and the existence of informational spillovers among potential users. Attributes of the innovation are usually related to technical features such as compatibility with existing solutions and may vary depending on the perception of potential adopters (Rogers, 1995).

Though literature on ICTs adoption especially in the Kenyan floriculture industry is largely scanty, HCDA (2013) reckons that over 90% operations in many flower farms are still manual. The World Bank Group (2011) also reckon that other than financial data, operations data in the Kenyan floriculture sector is largely disconnected, with different departments holding data autonomously. This, the World Bank suggests would be addressed through technology investments. To understand the intrisics behind investments in technology, two contributions appear to be particularly influential for this particular study.

The first one is the 'innovation-decision process framework' as proposed by Rogers (1995), which focusses on the factors affecting the diffusion of innovations. The second is the 'technology acceptance model' as proposed by Davis *et al* (1989), which is specific to the adoption of ICTs. The 'innovation-decision process framework' seems to draw upon different economic, psychological and sociological traditions in an attempt to explain the stylised fact that the distribution of adopters typically follows a typical S-shaped curve. The 'technology acceptance' model on the other hand originates from the theory of reasoned action and aiming at predicting the attitude of potential users towards a new technology by focusing on individual

perceptions (Davis et al, 1989). Both approaches identify different attributes of innovations that drive or hinder the adoption and stress the importance of adopters' characteristics in evaluating costs and benefits which closely matches what any floriculture stakeholder would be looking for.

## **2.4 Drivers of ICT Adoption**

Various studies have been carried out with regard to the drivers of ICT and adoption of innovations in general. One such study is the diffusion of an innovation which is evaluated by the relative speed at which a technology or an innovation is adopted by the members of a social system and is measured by the number of adopters in a given time period. As an example if we consider in particular intra-farm adoption, the decision on whether to adopt a technology is informed by a number of factors such as the desire to increase operational efficiency in the farm, the need to improve market and market related information reach and profitability, as well as strategic reasons (Davis et al, 1989). The process of adoption is dependent upon several specific characteristics of an innovation as perceived by the potential adopters (Rogers, 1995).

Firstly, innovations must possess a *relative advantage* over the existing ideas, which in most flower farms is often manual. According to Rogers (1995), when a new technology, product or service emerges, individuals will evaluate both its economic profitability and other variables - degree of risk, decrease in discomfort, savings in time and effort, immediacy of rewards. The concept of relative advantage is very similar to the idea of *perceived usefulness* of the technology, as put forward by the 'technology acceptance' framework. In particular, perceived usefulness identifies the subjective probability that using a specific technology would increase one individual's job performance (Davis, 1989). It has to be noted, however, that the perception of potential users towards the relative advantage of a new technology varies considerably according to farm-specific characteristics. In particular, many emphasise the importance of facilitating conditions, which reflect the availability of resources needed to engage in the process of adoption.

Though potential adopters expect an innovation to be of great usefulness, they will at the beginning find it too difficult to use, such that performance benefits are outweighed by the costs

of learning. Thus, the extent to which an innovation is professed as relatively difficult to understand make use of, also referred to as *complexity* or *perceived difficulty of use* forms another important variable according to Rogers (1995).

Users often differ in their level of knowledge and skills regarding a specific technology and will perceive different levels of complexity in its use. Rogers, (1995) notes that if some individuals cannot use the technology because it requires a different knowledge base from the one they possess, they are likely to experience a process of ‘social exclusion’. In work set ups such as flower farms where people have different levels of education, complexity no doubt acts as an obstacle to the process of technology adoption. Implementing a complex new technology will require learning both at the individual and at the organisational level. Consequently, learning the technical knowhow required to use a complex technology successfully places a great demand on potential users. On the other hand, the simplicity of a technology can be related to the capacity of different users to understand and with minimal effort (Davis et al, 1989).

Lastly, potential adopters of technology also pay attention to the *compatibility* of the technology in question, which needs to be understood in terms of technical features, functional features as well as strategic needs of the organization (EFITA, 2007). Compatibility is especially important in the case of ICT adoption as facing out some of the legacy systems takes time, while a complete plunge onto new technologies would not only be risky but also expensive bringing in economic factors as a major determinant of adoption.

## **2.5 Challenges of ICT Adoption**

By its very nature, ICT adoption is relatively low especially in the developing countries. Past research suggest that majority of developing countries such as Kenya in sub-Saharan Africa still lag behind in the information revolution. Not surprisingly therefore, the quest for adoption of ICT in agriculture has been problematic and will require fundamental shifts in the management environment, as well as renewed attention to quest for ICT innovations. As an example, developed countries have 80 per cent of the world's Internet users, while the total international bandwidth for all of Africa is less than that of the city of São Paulo, Brazil (Kipsoi et al, 2012). Research carried out by Kipsoi *et al* (2012) on Challenges of ICT adoption in Kenya pointed to

bandwidth as one of the major barriers towards ICT adoption. Bandwidth limitations, he notes, in terms of quantity and quality coupled with poor infrastructure especially in the rural areas where one expects to find farms makes access to information costly, which in turn makes adoption of ICTs low.

According to EFITA (2007), the most notable factors that limit ICT adoption in agriculture according to respondents are lack of training with 39.0%, no perceived economic or other benefits with 35.5%, not enough time to spend on technology with 32.2% and cost of technology 26.0%. These results were relatively comparable to the outcomes of the previous EFITA (2003) that pointed to lack of ICT technical proficiency, too hard to use/unfriendly and fear of technology as the major constraints to ICTs adoption. On the other hand, Taragola *et al* (2011), on the other hand point to inadequate assistance in implementation of ICT, growers' traditions, farm managers' age, type and size of the farm, lack of ICTs dependability, inadequate managerial experience, lack of connection with research as well as fear of loss of control as the major limitations towards adoption in agriculture.

## **2.6 Summary of the Literature Review**

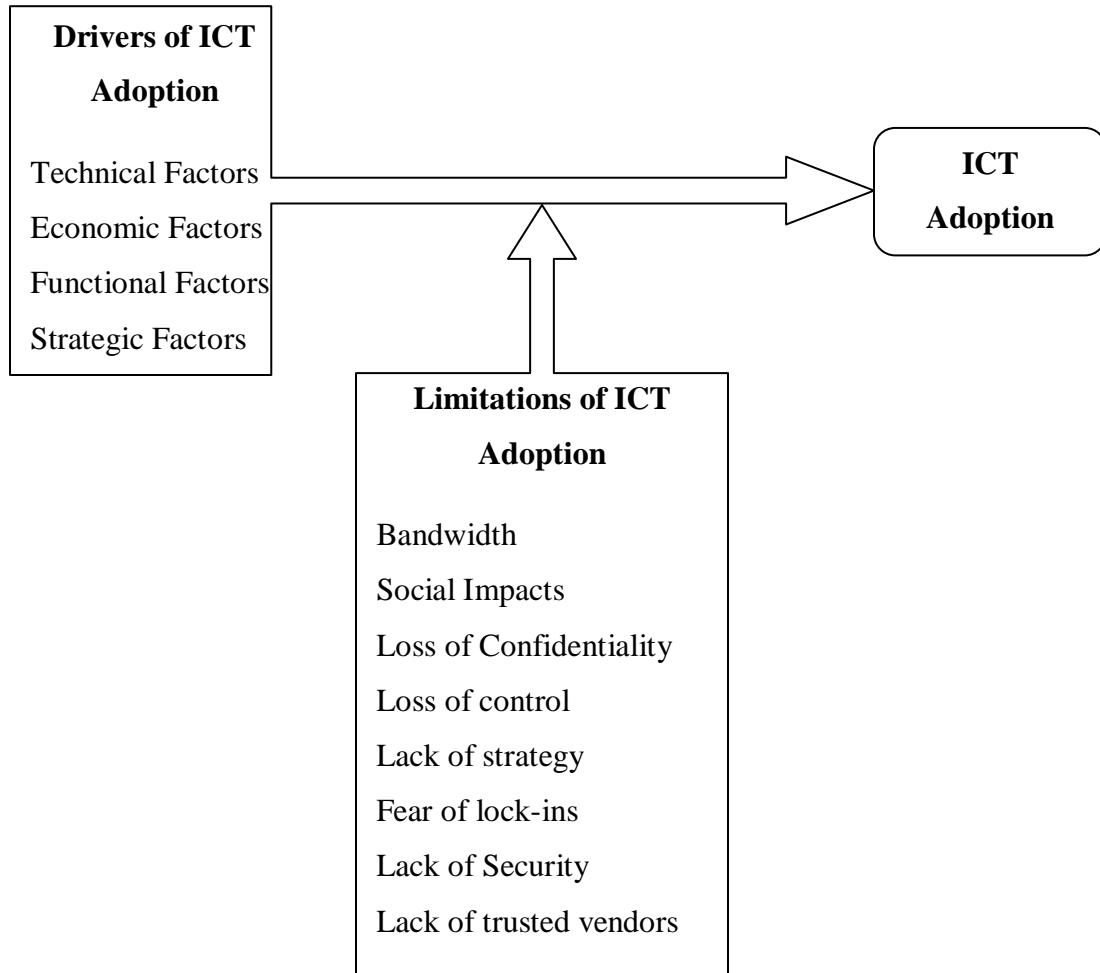
The chapter has provided insights of other reserachses and scholars on ICTs adoption in agriculture. In conclusion, various researches seem to point to different directions with regard to ICTs adoption. There doesn't seem to be an agreed upon drivers or challenges to ICTs adoption. Though the drivers of ICTs adoption seem to fall either Technical, Economic, Functional or Strategic factors, the limitions to ICTs adoption seem to differ from research to another. However, all resarchses seem to agree that to adopt ICT tools, systems and strategies, the benefits must outway the investment and operational costs. Consequaently, commercial issues and potential returns drive adoption as beyond a certain level of ICTs adoption and diffusion, marginal investments in innovations do not translate to proportional returns. Beyond this point, most farms will opt to retain their traditional business processes.

The framework for drivers and challenges of ICTs adoption takes into account the factors that affect the farms' decision to adopt or not to adopt technology, and with the nature of operations at the central point. There is need therefore to conceptualize a model construct that can be used

to examine the causal relationship between drivers of ICTs adoption and the limiting factors to ICTs adoption. The framework will inform this study through taking into account the assumptions, expectations, beliefs and various issues relating to ICTs adoption.

The drivers categorized as economic, functional, technical and strategic factors inform management decisions on whether or not to adopt ICTs. On the other hand, bandwidth, social impacts, fear of loss of confidentiality, fear of loss of control, lack of ICTs adoption strategies, fear of lock-ins, lack of proper ICT security mechanisms as well as lack of trusted vendors in the market often hamper the likelihood of ICTs adoption and therefore need to be addressed as shown in Figure 1.1.

Figure 1.1: Conceptual Model



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter outlines the research methodology that was used in the study, beginning with a discussion on the research design to be adopted. Additionally, the chapter discusses the population and the sampling design, the data collection methods used, as well as the research procedures that were followed. The chapter concludes by discussing the data analysis as well as the presentation methods used.

### **3.2 Research Design**

A cross sectional type of descriptive survey design was utilized in conducting this study. A cross sectional study takes a snapshot of a population at a certain time, allowing conclusions about phenomena across a wide population to be drawn (Bryman & Bell, 2001). This allowed the researcher to focus on the population groups therefore understanding the wider picture.

### **3.3 The Population**

A population, according to Schindler (2000), is the total of all the individuals who have certain characteristics and are of interest to a researcher. Schindler further states that the basic idea behind sampling is that by doing so, a researcher is able to draw a conclusion about the entire population. A large set of observation can be termed as a population while a subset of the same can be termed as a sample. For this particular study, the population was the list of all Kenyan flower farms as provided by the KFC (2014).

KFC (2014) lists 151 as registered flower farms in Kenya. This formed the study population from which a convenient sample was taken based on the sampling design in order to represent the rest of the floricultural farms in Kenya. The study proposes to survey the Farm Managers (Management Level) of the sampled organizations as they are key decision makers in order to get the general behavior factors that influence adoption of ICTs in the floriculture sector.

### **3.4 Sampling Design**

Sampling design involves the determination of the number of participants. A sample is therefore a group of respondents, cases or records comprising of part of the entire study population that is empirically selected to represent the study population, while a good sample must be accurate, precise, and representative of the total population (Schindler, 2000).

The random sampling was used to select the sample. The proposed sample therefore was 45 as advised by Schindler (2000) who proposes that 30% of the study population is an adequate representative.

### **3.5 Data Collection**

Data was collected with the help of a questionnaire. The questionnaire has five sections A-D with Section A focusing on demographics of the intended respondents, Section B focusing on the Extent of ICT Adoption in the different floricultural farms in Kenya, Section C focusing on the Drivers of ICT Adoption and Section D focusing on the Challenges of ICTs Adoption. In each of the 45 sampled flower farms, a questionnaire was administered to the farm manager using “drop and pick later” approach.

### **3.6 Data Analysis**

Once received, the completed questionnaires were checked for completeness and data cleansing carried out. Data analysis was then done in line with the different sections of demographics, extent of ICT adoption, drivers of ICT adoption as well as challenges of ICTs adoption using statistical package for social sciences (SPSS). This analysis was based on quantitative approach using descriptive statistics. In the demographics section of the questionnaire, statistical measures such as frequencies and percentages were used. In the extent, drivers and challenges sections, means and standard deviations were used. Further, to establish the relationship between drivers of ICT adoption and levels of adoption in the floricultural farms, regression analysis was used as shown in the following model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Whereby       $Y$  = ICT adoption

$X_1$  = economic drivers

$X_2$  = functional drivers

$X_3$  = Technical drivers

$X_4$  = Strategic drivers

$\epsilon$  = Error term       $\beta_0$     is the intercept.

## CHAPTER FOUR: DATA ANALYSIS

### 4.1 Introduction

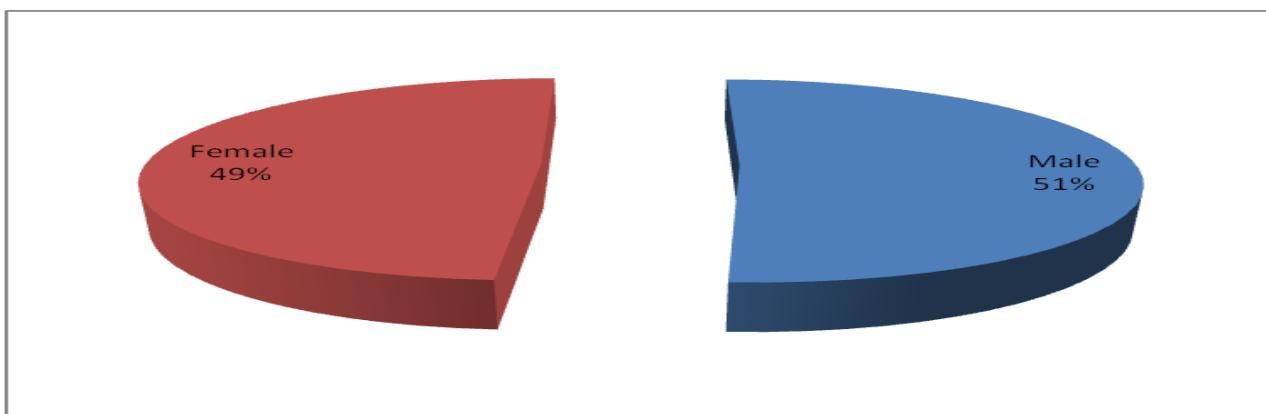
This chapter presented the data analysis and discussion on the Extent, Drivers and Challenges of ICT Adoption in the Floricultural Farms in Kenya. The data was collected in the form of questionnaire and analysed using tally method. Out of the 45 questionnaires distributed, 40 responded and returned their questionnaires contributing to the response rate of 88.9%. This response rate was sufficient and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. This commendable response rate was due to extra efforts that were made via personal calls and visits to remind the respondent to fill-in and return the questionnaires. The chapter covers the demographic information, Extent, Drivers and Challenges of ICT Adoption in the Floricultural Farms in Kenya and the findings are based on the objectives.

### 4.2 Demographic Characteristics

#### 4.2.1 Gender

The study sought to establish the respondent's gender distribution. The findings are as stipulated in Figure 4.2.1.

Figure 4.2.1: Gender



Source: Fieldwork (2014)

Table 4.2.1: Gender

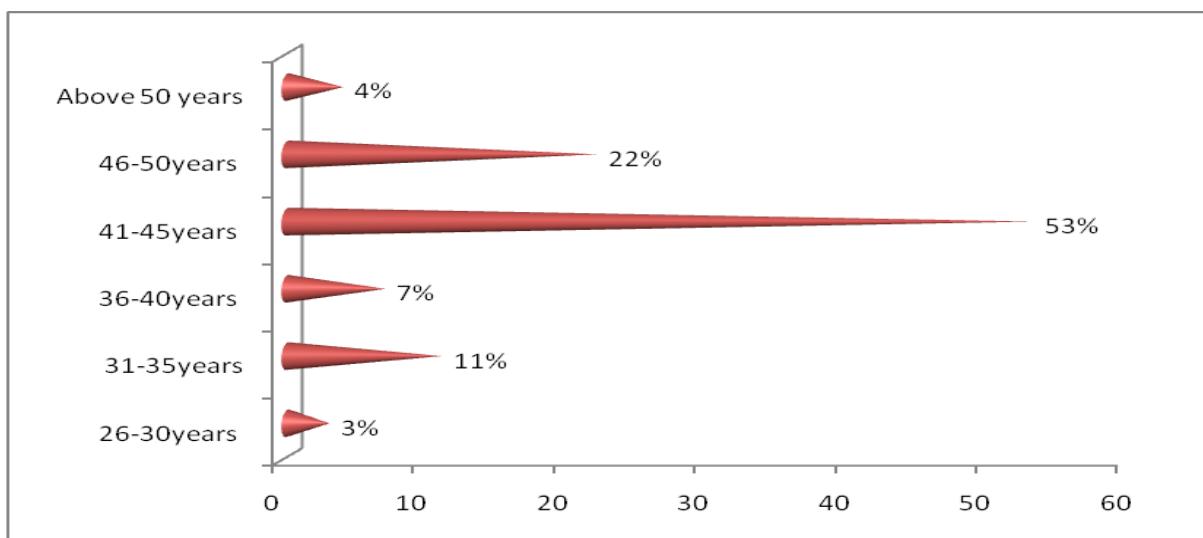
<b>Number of employees</b>	<b>Frequency</b>	<b>Percent</b>
Male	21	51
Female	19	49
<b>Total</b>	<b>40</b>	<b>100</b>

From the findings as illustrated in Table 4.2.1 the majority of the respondents (51%) were males while 49% were females. This illustrates that there is gender disparity as majority of the respondents are males.

#### 4.2.2 Age

The study also sought to establish the age distribution of the respondent. The collected data was analysed as shown in Figure 4.2.2

Figure 4.2.2: Age



**Source:** Fieldwork (2014)

Table 4.2.2: Age

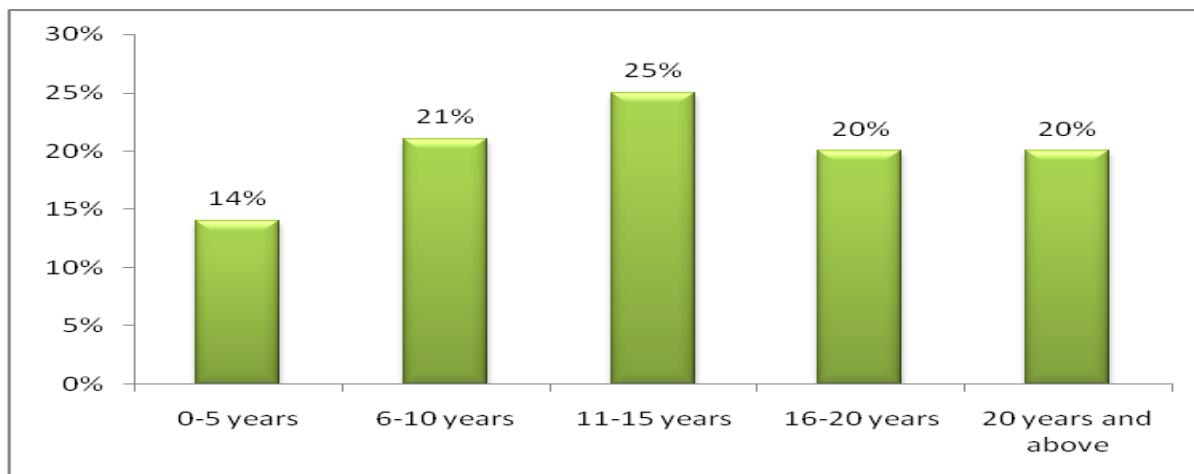
<b>Number of years</b>	<b>Frequency</b>	<b>Percent</b>
26-30	1	3
31-35	4	11
36-40	3	7
41-45	21	53
46-50	9	22
Above 50 years	2	4
<b>Total</b>	<b>40</b>	<b>100</b>

With respect to age distribution of the respondents, Figure 4.2.2 shows that (53%) of the respondents were aged between 31-35 years, 22% of the respondents are within the age group 40-50 years, 11% were within the age group 31-35 years, 7% of respondents were within the age group 36-40 years and 4% were above 50 years of age. This implies that majority of the respondents were within the economic active age group of 31-35 years.

#### 4.2.3 Work Experience

The research sought to establish respondents' working experience based on the number of years they have worked. The findings are as stipulated in Figure 4.2.3

Figure 4.2.3: Work Experience



**Source:** Fieldwork (2014)

Table 4.2.3: Work Experience

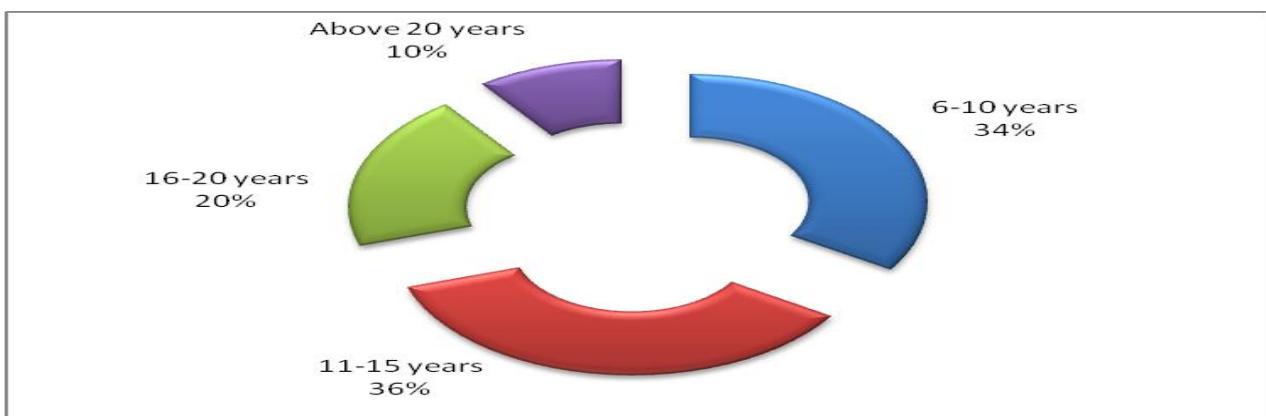
<b>Number of years</b>	<b>Frequency</b>	<b>Percent</b>
0-5	6	14
6-10	8	21
11-15	10	25
16-20	8	20
More than 20years	8	20
<b>Total</b>	<b>40</b>	<b>100</b>

From Table 4.2.3, most of the respondents (25%) had worked for 11-15 years, 21% for 6-10 years, 20% for 16-20 years and above 20 years respectively and 14% had worked for 0-5 years. This illustrates that the respondents had worked with the floricultural farms for a long period to give credible information on the Information and Communication Technology adoption in the floricultural farms in Kenya. It also depicts that the respondents were highly experienced owing to the many years they had worked in the floricultural farms.

#### 4.2.4 Age of the Farm

The study also sought to establish the age of the farm. The collected data was analysed and findings are as stipulated in Figure 4.2.4

Figure 4.2.4: Age of the Farm



**Source:** Fieldwork (2014)

Table 4.2.4: Age of the Farm

<b>Number of years</b>	<b>Frequency</b>	<b>Percent</b>
6-10	14	34
11-15	14	36
16-20	8	20
More than 20years	4	10
<b>Total</b>	<b>40</b>	<b>100</b>

With respect to the duration which the floricultural farms had been in existence, the study established that most (36%) of the floricultural farms had been in existence for a period of between 11-15 years, 34% for between 6-10 years, 20% for between 16-20 years while 10% of the floricultural farms had been in existence for more than 20 years. This implies that majority of the floricultural farms had been in existence for a period of between 11-15 years.

#### **4.2.5 Number of Employees**

The study also sought to establish the number of employees that the floricultural farm had. The data collected was analysed and the findings are as stipulated in Table 4.2.5

Table 4.2.5: Number of Employees

<b>Number of employees</b>	<b>Frequency</b>	<b>Percent</b>
26-50	1	2.5
51-75	2	5
76-100	3	7.5
101-125	4	10
126-150	6	15
151-175	6	15
176-200	8	20
More than 200	10	25
<b>Total</b>	<b>40</b>	<b>100</b>

From the study findings, most (25%) of the floricultural farms had more than 200 employees, 20% had between 176-200 employees while 15% had between 126-175 employees. This implies that majority of the floricultural farms were big as indicated by the large number of employees.

#### **4.2.6 Farms' Annual Revenue in Kenya Shillings**

The study also sought to establish the floricultural farm's annual revenue in Kenya shillings. The financial data collected was analysed and the findings are as stipulated in Table 4.2.6

Table 4.2.6: Farms' Annual Revenue in Kenya Shillings

<b>Annual Revenue</b>	<b>Frequency</b>	<b>Percentage</b>
1,000,000-5,000,000	2	5
6,000,000-10,000,000	3	7.5
11,000,000-15,000,000	5	12.5
16,000,000-20,000,000	3	7.5
21,000,000-25,000,000	4	10
26,000,000-30,000,000	4	10
31,000,000-35,000,000	6	15
36,000,000-40,000,000	4	10
41,000,000-45,000,000	1	2.5
46,000,000-50,000,000	3	7.5
> 50,000,000	2	5
<b>TOTAL</b>	<b>40</b>	<b>100</b>

**Source: Fieldwork (2014)**

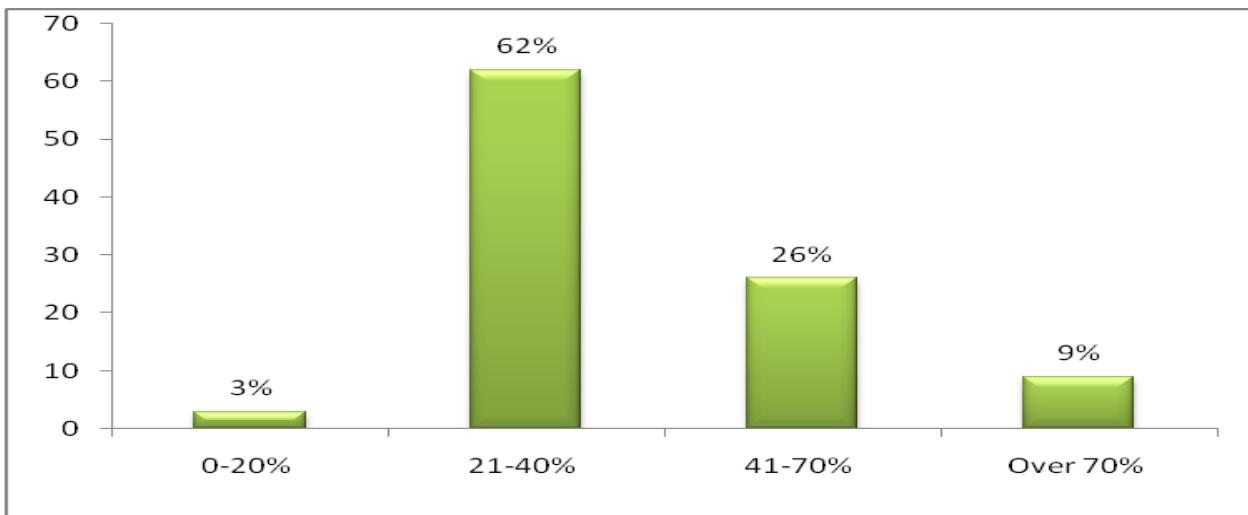
From the study findings, most (12.5%) of the floricultural farm had annual revenue of between Kenya shillings 6,000,000-10,000,000, 7.5% between 1,000,000-5,000,000 while 10% had an annual revenue of between Kenya shillings 16,000,000-20,000,000, 21,000,000-25,000,000 and 31,000,000-35,000,000 respectively. This implies that majority of the floricultural farms were big as indicated by their annual revenue of between Kenya shillings 6,000,000-10,000,000.

#### **4.3 Extent of ICT Adoption**

##### **4.3.1 Level of Computerization in the Farms**

The study sought to establish the level of computerization in the floricultural farms. The collected data was analysed and the findings are as stipulated in Figure 4.3.1

Figure 4.3.1: Level of Computerization in the Farms



**Source: Fieldwork (2014)**

Table 4.3.1: Level of Computerization in the Farms

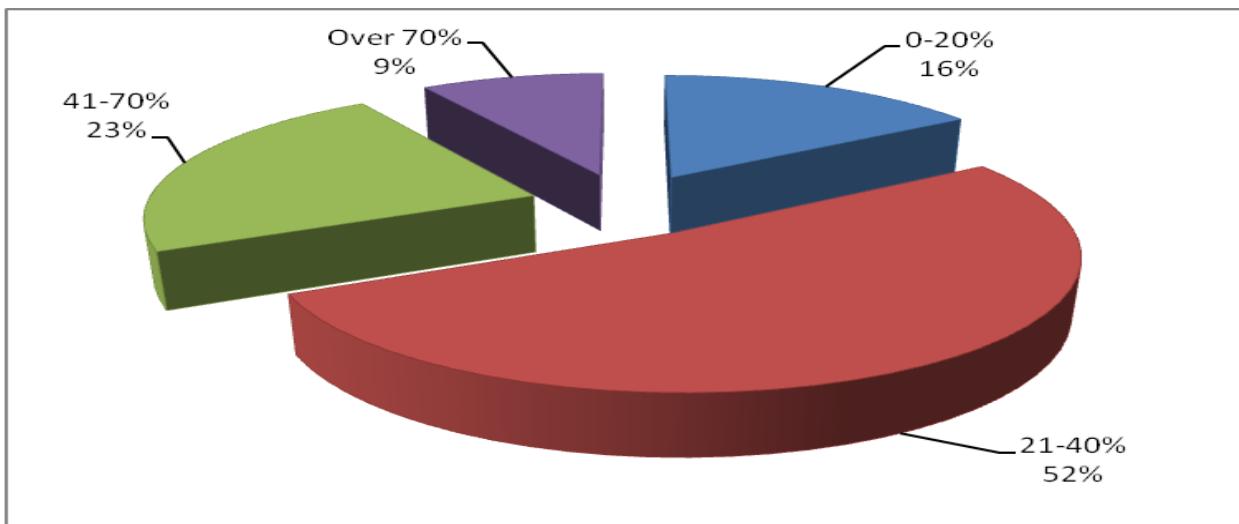
Level of Computerization	Frequency	Percent
0-20	1	3
21-40	25	62
41-70	10	26
Over 70	4	9
<b>Total</b>	<b>40</b>	<b>100</b>

From the study findings in Table 4.3.1, majority (62%) of the respondents indicated that the level of computerization in their farm was between 21-40%, 26% indicated that it was between 41-70% while 9% indicated that the level of computerization in their farm was over 70%. This implies that majority of the floricultural farms had low levels of computerization in the farm of between 21-40%.

### 4.3.2 Operations Interrelated Through Computerization

The study sought to establish the percentage of operations that were interrelated through computerization. The findings are as stipulated in Figure 4.3.2

Figure 4.3.2: Operations Interrelated Through Computerization



Source: Fieldwork (2014)

Table 4.3. 2: Operations Interrelated Through Computerization

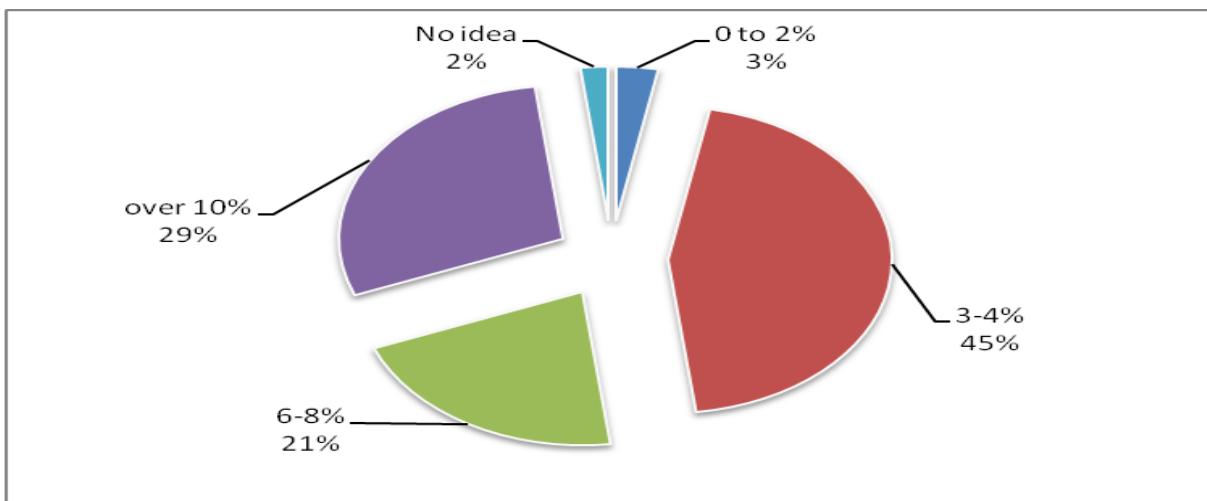
Operations Interrelated Through Computerization	Frequency	Percent
0-20	6	16
21-40	21	52
41-70	9	23
Over 70	4	9
<b>Total</b>	<b>40</b>	<b>100</b>

From the study findings in Table 4.3.2, majority (52%) of the respondents indicated that the percentage of operations that were interrelated through computerization in their farm was between 21-40%, 23% indicated that it was between 41-70% while 16% indicated that the percentage of operations that were interrelated through computerization in their farm was between 0-20%. This implies that the percentage of operations that were interrelated through computerization in the floricultural farms was between 21-40%.

### 4.3.3 Budget Allocated To ICT

The study sought to establish the percentage of the entire farm budget allocated to ICT as this could be an indicator of the management commitment towards ICT adoption. The data collected was analysed and the findings are as stipulated in figure 4.3.3.

Figure 4.3.3: Budget Allocated To ICT



Source: Fieldwork (2014)

Table 4.3.3: Budget Allocated To ICT

Budget Allocation	Frequency	Percent
0-2	1	3
3-4	18	45
6-8	8	21
Over 10	12	29
No idea	1	2
<b>Total</b>	<b>40</b>	<b>100</b>

From the study findings, most (45%) of the respondents indicated that the entire farm budget allocated to ICT was between 3-4%, 29% indicated that it was over 10% while 21% indicated that the entire farm budget allocated to ICT was between 6-8%. This implies that the entire farm budget allocated to ICT was between 3-4%.

#### **4.3.4 Extent of Adoption of ICT Applications in Floricultural Farms**

The study also sought to establish the extent to which various ICT applications had been adopted in the floricultural farms. The responses were rated on a five point Likert scale indicating to what extent respondents agree to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.3.4.

Table 4.3.4: Extent of Adoption of ICT Applications in Floricultural Farms

<b>Extent of Adoption of ICT application</b>	<b>Mean</b>	<b>STDv</b>
Internet and emails	4.65	0.482
Office, procurement and accounting automation systems such as sage pastel, dansoft, Dynamics Navision	4.44	0.524
Computerized planting systems e.g teff planting machine	1.53	1.621
Computer storage and servers	4.66	0.542
Computerized irrigation and fertigation systems	4.11	0.057
Field operations applications e.g Scarab for pest and disease monitoring	3.48	0.626
Automated packing systems	3.45	0.162
Computerized storage and refrigeration systems	3.89	1.015

#### **Source: Fieldwork (2014)**

From the study findings in Table 4.3.4, majority of the respondents agreed to a very great extent that computer storage and servers, internet and emails, Office, procurement and accounting automation systems such as sage pastel, Dansoft, Microsoft Dynamics Navision and computerized irrigation and fertigation systems as examples of ICT applications had been adopted in the Floricultural Farms as shown by the mean scores of 4.66, 4.65, 4.44 and 4.11 respectively. On the other hand, most of the respondents agreed to a moderate extent that computerized storage and refrigeration systems, field operations applications such as Scarab for pest and disease monitoring and automated packing systems as other examples of ICT applications had been adopted in the floricultural farms as shown by the mean scores of 3.89, 3.48 and 3.45 respectively. From the above findings it is clear that computer storage and servers,

internet and emails, Office, procurement and accounting automation systems such as sage pastel, Dansoft, Microsoft Dynamics Navision and computerized irrigation and fertigation systems were the widely already applied ICT applications.

#### **4.4 Drivers of ICT Adoption**

##### **4.4.1 Economic Drivers**

The study sought to establish the extent to which the following were economic drivers for adoption of ICT in the farm. The responses were rated on a five point Likert scale indicating to what extent respondents agree to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.4.1.

Table 4.4.1: Economic Drivers

<b>Economic Drivers</b>	<b>Mean</b>	<b>STDs</b>
Cost of ICT deployment	4.63	0.971
Cost saving	4.23	0.308
Desire to increase revenues	3.63	0.808

##### **Source: Fieldwork (2014)**

From the study findings in Table 4.4.1, majority of the respondents strongly agree that cost of ICT deployment and cost saving were the strongest economic drivers for adoption of ICT in the farms as shown by the mean scores of 4.63 and 4.23 respectively. On the other hand, most of the respondents agreed but only to a moderate extent that desire to increase revenues were the economic drivers for adoption of ICT in the farm as shown by the mean score of 3.63. This implies that that cost of ICT deployment and cost saving were the major economic drivers for adoption of ICT in the various farms.

#### **4.4.2 Functional Factors**

The study sought to establish the extent to which the following were functional drivers for adoption of ICT in the farms. The responses were rated on a five point Likert scale indicating to what extent respondents agree to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS.

Table 4.4.2: Functional Factors

<b>Functional Drivers</b>	<b>Mean</b>	<b>STDev</b>
Operations streamlining	4.65	0.482
Operations speed	4.34	0.5
Operations interdependence	4.13	0.62

#### **Source: Fieldwork (2014)**

From the study findings in Table 4.4.2, majority of the respondents strongly agree that operations streamlining, operations speed and operations interdependence were strong functional drivers for adoption of ICT in the farms as shown by the mean scores of 4.65, 4.34 and 4.13 respectively.

#### **4.4.3 Technical Drivers**

The study sought to establish the extent to which the following were technical drivers for adoption of ICT in the farm. The responses were rated on a five point Likert scale indicating to what extent respondents agree to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.4.3.

Table 4.4.3: Technical Drivers

<b>Technical Drivers</b>	<b>Mean</b>	<b>STDev</b>
Simplicity in use of the ICT tools and systems	4.63	0.162
Security of the ICT tools and systems	4.45	1.01
Scalability of the ICT tools and systems	4.16	0.223
Availability/uptime of the ICT systems	3.89	1.498
Performance of the ICT tools and systems	3.40	1.321
Flexibility of the ICT tools and systems	3.19	0.971

#### **Source: Fieldwork (2014)**

From the study findings in Table 4.4.3, majority of the respondents strongly agree that simplicity in use of the ICT tools and systems, security of the ICT tools and systems and scalability of the ICT tools and systems were indeed technical drivers for adoption of ICT in the farms as shown by the mean scores of 4.63, 4.45 and 4.16 respectively. On the other hand, most of the respondents agreed but only to a moderate extent that availability/uptime of the ICT systems, performance of the ICT tools and systems and flexibility of the ICT tools and systems were the technical drivers for adoption of ICT in the farms as shown by the mean scores of 3.89, 3.40 and 3.19 respectively.

#### **4.4.4 Strategic Drivers**

Lastly, the study sought to establish the extent to which the following were strategic drivers for adoption of ICT in the farm. The responses were rated on a five point Likert scale indicating to what extent respondents agree to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in table below.

Table 4.4.4: Strategic Drivers

Strategic Drivers	Mean	STDev
Cost reduction	4.83	0.971
Focus on core competences	4.43	1.131
Inter-farms collaboration	3.84	0.948
Transformation of operations	3.67	0.913
Availability/uptime of the ICT systems	3.63	0.308
Diversification	4.62	1.133

#### **Source: Fieldwork (2014)**

From the study findings in Table 4.4.4, majority of the respondents strongly agree that cost reduction, diversification and focus on core competences were the strategic drivers for adoption of ICT in the farm as shown by the mean scores of 4.83, 4.62 and 4.43 respectively. On the other hand, most of the respondents agreed to a moderate extent that inter-farms collaboration, transformation of operations and availability/uptime of the ICT systems were the strategic drivers for adoption of ICT in the farms as shown by the mean scores of 3.84, 3.67 and 3.63 respectively.

#### **4.5 Challenges of ICT Adoption**

The study further sought to establish the extent to which the farms had faced various challenges in ICT adoption. The responses were rated on a five point Likert scale indicating to what extent respondents agreed to the statements, where: 1- No extent, 2- Little extent, 3- Moderate extent, 4- Great extent and 5- Very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.5.1.

Table 4.5.1: Challenges of ICT Adoption

<b>Challenges of ICT Adoption</b>	<b>Mean</b>	<b>STDev</b>
Fear of loss of data/information confidentiality	4.66	0.482
Fear of loss of data/information control	4.65	0.524
Lack of a clear ICT strategy	4.53	0.621
Insufficient internet connectivity and bandwidth	4.48	0.542
Impact on operations	4.45	0.057
Lack of security and proper Service Agreement Levels (SLAs)	2.45	0.626
Lock ins to ICT infrastructure and service vendors	4.45	0.162
Inability to quantify ICT benefits	4.44	1.015
Culture of the farm	4.11	0.223
Maturity level of the farm	3.89	1.498
Technical capability of the staff members	3.53	1.321
Fear of overdependence on ICT	3.40	0.971
Cost of ICT tools deployment	2.89	0.162
Fear of dealing with viruses, trojans, malware, phishing etc	2.44	1.019
Unpopularity among workers over loss of jobs	2.16	0.223

**Source: Fieldwork (2014)**

From the study findings in Table 4.5.1, majority of the respondents strongly agree that fear of loss of data/information confidentiality, fear of loss of data/information control, lack of a clear ICT strategy, insufficient internet connectivity and bandwidth, lock ins to ICT infrastructure and service vendors, inability to quantify ICT benefits and culture of the farm were the challenges faced by the farms in ICT adoption as shown by the mean scores of 4.48, 4.66, 4.65, 4.53, 4.45, 4.44 and 4.11 respectively. Most of the respondents also agreed to a great extent that maturity level of the farm, technical capability of the staff members and fear of overdependence on ICT were the challenges faced by the farms in ICT adoption as shown by the mean scores of 3.89, 3.53 and 3.40 respectively. The analysis of these factors therefore reveals that different factors influenced ICT adoption among floricultural farms.

## 4.6 Relationship Between Drivers and ICT Adoption

### 4.6.1 Coefficient of Correlation

To ascertain the perceived relationship between the drivers of ICT and adoption levels among the horticultural farms, the study employed Pearson's product moment correlation analysis through coefficient of determination, regression analysis and regression coefficient on economic drivers, functional drivers, technical drivers and strategic drivers. To compute the correlation (strength) between the study variables and their findings, the researcher used the Karl Pearson's coefficient of correlation ( $r$ ). From the findings, it was clear that there was a positive correlation between economic, functional, technical and strategic drivers and ICT adoption as shown on Table 4.6.1.

Table 4.6.1: Coefficient of Correlation

		ICT Adoption	Economic drivers	Functional factors	Technical factors	Strategic Drivers
ICT Adoption	Pearson Correlation	1				
		Sig. (2-tailed)				
Economic drivers	Pearson Correlation	.324	1			
		Sig. (2-tailed)	.0032			
Functional factors	Pearson Correlation	.3972	.3421	1		
		Sig. (2-tailed)	.0021	.0014		
Technical drivers	Pearson Correlation	.3765	.1240	.0621	1	
		Sig. (2-tailed)	.0043	.0120	.0043	.0987
Strategic Drivers	Pearson Correlation	.5632	.2354	.0345	.4538	1
		Sig. (2-tailed)	.0034	.0234	.0124	.4324

#### 4.6.2 Regression Coefficient

Multiple regression analysis was conducted as to establish the extent of technology adoption on information and communication among the horticultural farms in Kenya and the four variables. As per Table 4.6.2, the equation

$(Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon)$  becomes:

$$Y = 1.675 + 0.334X_1 + 0.674X_2 + 0.345X_3 + 0.436X_4$$

Table 4.6.2: Regression Coefficient

<b>Model</b>	<b>Unstandardized Coefficients</b>		<b>Standardize d Coefficients</b>		
	<b>B</b>	<b>Std. Error</b>	<b>Beta</b>	<b>T</b>	<b>Sig.</b>
(Constant)	1.308	1.342		1.623	0.357
Economic Drivers	0.334	0.310	0.172	4.342	.0276
Functional factors	0.674	0.156	0.210	3.592	.0285
Technical factors	0.345	0.322	0.097	3.542	.0202
Strategic factors	0.897	0.785	0.897	3.986	.0865

The regression analysis as per Table 4.6.2 shows that taking the four ICT drivers into account (economic drivers, functional drivers, technical drivers and strategic drivers) at zero, ICT adoption will be 1.308. The findings presented also show that taking all other independent variables at zero, a unit increase in economic drivers will lead to a 0.334 increase in ICT adoption; a unit increase in functional drivers will lead to a 0.674 increase in ICT adoption, a unit increase in technical drivers will lead to a 0.345 increase in ICT adoption and a unit increase in strategic drivers will lead to a 0.897 increase in ICT adoption. This infers that strategic drivers

was most effective to ICT adoption followed by functional factors, then technical factors while increase in economic factors contributed the least to ICT adoption.

#### **4.6.3 Coefficient of Determination**

Consequently the researcher conducted a multiple regression analysis so as to analyze the extent of technology adoption on information and Communication. The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study.

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (ICT adoption) that is explained by the four drivers of ICT adoption (economic drivers, functional drivers, technical and strategic factors).

Table 4.6.3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.280	0.786	0.751	0.4538

The four independent variables (drivers of ICT adoption) that were studied, explain only 78.6% of ICT adoption as represented by the adjusted  $R^2$ . This therefore means that other factors not studied in this research contribute 21.4% of ICT adoption. Therefore, further research should be conducted to investigate the other factors (21.4%) of the ICT adoption.

#### 4.6.4 ANOVA

Table 4.6.4: ANOVA (Analysis of Variance)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.424	9	.208	2.34	.003 <sup>a</sup>
	Residual	5.375	20	.232		
	Total	6.799	29			

a. Predictors: (Constant), Economic drivers, functional drivers, strategic drivers and technical drivers)

b. Dependent Variable: ICT Adoption.

Analysis of Variance (ANOVA) consists of calculations that provide information about levels of variability within a regression model and form a basis for tests of significance. The "F" column provides a statistic for testing the hypothesis that all  $\beta \neq 0$  against the null hypothesis that  $\beta = 0$  (Weisberg, 2005). From the findings the significance value is .003 which is less than 0.05 thus the model is statistically significant in predicting how economic drivers, functional factors, strategic factors and technical factors affects ICT adoption. The F critical at 5% level of significance was 2.34. Since F calculated is greater than the F critical (value = 2.21), this shows that the overall model was significant in predicting how the drivers contributed towards ICT adoption.

## **CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter presents summary, conclusions and recommendations of the study on Information and Communication Technology Adoption in the Floricultural Farms in Kenya.

### **5.2 Summary**

The study identified that computer storage and servers, internet and emails, computerized planting systems e.g teff planting machine, Office, procurement and accounting automation systems such as sage pastel, dansoft, Dynamics Navision and computerized irrigation and fertigation systems as the most widely adopted ICT applications in the Floricultural Farm Kenya.

The study also established that cost of ICT deployment and cost saving were the greatest economic drivers of adoption of ICT in the farms, while operations streamlining, operations speed and operations interdependence were the main functional drivers behind adoption of ICT in the farms. Further, simplicity in use of the ICT tools and systems, security of the ICT tools and systems and scalability of the ICT tools and systems were identified as the technical drivers for adoption of ICT in the farms while cost reduction, diversification and focus on core competences were identified as the strategic drivers for adoption of ICT in the floricultural farms in Kenya.

The study further established that fear of loss of data/information confidentiality, fear of loss of data/information control, lack of a clear ICT strategy, insufficient internet connectivity and bandwidth, lock ins to ICT infrastructure and service vendors, inability to quantify ICT benefits and culture of the farm were challenges faced by the farms in ICT adoption. Additionally, maturity level of the farm, technical capability of the staff members and fear of overdependence on ICT were also challenges to ICT adoption among the farms.

### **5.3 Conclusions**

The study concludes that majority of the respondents were males aged 31-35 years and had worked for 11-15 years. Further, majority of the floricultural farms had been in existence for a

period of between 11-15 years, had more than 200 employees and had annual revenue of between Kenya shillings 21,000,000-25,000,000. The study also concluded that computer storage and servers, internet and emails, computerized planting systems e.g teff planting machine, Office, procurement and accounting automation systems such as sage pastel, dansoft, Dynamics Navision and computerized irrigation and fertigation systems as the ICT applications that had been adopted in the floricultural farms.

Further, cost of ICT deployment and cost saving were the economic drivers for adoption of ICT in the farms, operations streamlining, operations speed and operations interdependence were the functional drivers for adoption of ICT in the farm, simplicity in use of the ICT tools and systems, security of the ICT tools and systems and scalability of the ICT tools and systems were the technical drivers for adoption of ICT in the farms, while cost reduction, diversification and focus on core competences were the strategic drivers for adoption of ICT in the farms respectively.

Lastly, the study concluded that fear of loss of data/information confidentiality, fear of loss of data/information control, lack of a clear ICT strategy, insufficient internet connectivity and bandwidth, lock ins to ICT infrastructure and service vendors, inability to quantify ICT benefits and culture of the farms were the challenges faced by the farms in regard to ICT adoption. Other challenges limiting ICT adoption as identified by this study included maturity level of the farm, technical capability of the staff members and fear of overdependence on ICT.

#### **5.4 Recommendations**

Though the Kenyan flower industry represents a rich and well-established contribution to the Kenyan economy, the study recommends that the sustainability will greatly depend on investment in technology. This is inevitably the future. To adopt ICT tools, systems and strategies, the benefits must outweigh the investment and operational costs. Consequently, commercial issues and potential returns drive adoption as beyond a certain level of ICTs adoption and diffusion, marginal investments in innovations do not translate to proportional returns. Beyond this point, most farms should opt to retain their traditional business processes.

The framework for drivers and challenges of ICTs adoption must take into account the factors that affect the farms' decision to adopt or not to adopt technology, and with the nature of operations at the central point. There is need therefore to conceptualize a model construct that can be used to examine the causal relationship between drivers of ICTs adoption and the limiting factors to ICTs adoption. Such a framework would inform adoption decisions through taking into account the assumptions, expectations, beliefs and various issues relating to ICTs adoption.

### **5.5 Limitations of the Study**

Due to time and resources constraints, the study evaluated the many and diverse processes in the floricultural farms wholesomely. It is possible that different functions in a floricultural farm may have different levels of ICT adoption and varying ICT budgets. Further, the study administered a single questionnaire per farm, implying that there was no moderation of biasness. Lastly, the study relied on primary data only and did not take into account secondary data such as that collected during other previous and related studies.

### **5.6 Recommendations for Further Study**

The study suggests that further research should be done on the drivers and challenges of ICT adoption. This will assist in identifying the exact factors in the different categories that inform the decision to adopt or not adopt technology by floricultural farms. The study also suggests further research to be done on the extent of ICT adoption through narrowing down to the various specific ICT applications order to depict reliable information that illustrates real situation in all floricultural farms in Kenya.

## REFERENCES

- Awour, E. (2012). Environmental tensions and compatibilities in agribusiness supply networks: a case of the floriculture industry in kenya. *Journal of Biology, Agriculture and Healthcare*, 2, 17-26.
- Awuor, E. (2012). The Floriculture Industry In Kenya:A complex Adaptive Environment. *European Journal of Business and Management* , 4, 64-70.
- Badgery-Parker, J. J. (2011). *Green house Horticulture*. Amsterdam : Churchill Fellowship .
- Bryman, A., & Bell, E. (2001). *BUsiness Research Methods*. London: Oxford University Press.
- Davis, F. D., Davis, G. B., Morris, M. G., & Venkatesh, V. (1989). Technology Acceptance Model. *Journal of Management Science* , 982 - 1003.
- EFITA (2007). *ICT Adoption In Agriculture*. Glasgow.
- EPC (2014). *Exports Statistics*. Retrieved April 12, 2014, from Exports Promotion Council: [http://epckenya.org/index.php?option=com\\_content&task=view&id=43&Itemid=62](http://epckenya.org/index.php?option=com_content&task=view&id=43&Itemid=62)
- Getu, M. (2009). Ethiopian Floriculture and its impact on the environment. *Regulation, Supervision and Compliance-Mizan Law Review* , 3 (240), 2.
- GFAR (2012). *Adoption of ICT\* Enabled Information Systems for Agricultural Development and Rural Viability*. Atsugi, Japan.
- Hall, B. H., & Khan, B. (2002). *Adoption of New Technology*. California: University of California.
- HCDA (2013). *Horticultural Crops Development Authority*. Retrieved April 15, 2014, from Horticultural Crops Development Authority: <http://www.hcda.or.ke/>
- Herath, H. M., Zoysa, D., & Karunananda, A. (2004). Application of information and communication technology in floriculture sector: a case study in Bandarawela and

Nuwaraeliya. *Proceedings of the 8th Academic Sessions, University of Ruhuna 2010*, (p. 13).

Kangogo, J., Wario, G., Bowen, M., & Ragui, M. (2013). Supply Chain Disruption in the Kenya Floriculture Industry: A Case of Equator Flowers. *European Journal of Business and Management* , 5, 246-253.

KFC (2014). *floriculture-in-kenya*. Retrieved April 13, 2014, from Kenya Flower Council: <http://www.kenyaflowercouncil.org/index.php/2013-03-24-08-12-08/floriculture-in-kenya>

Kipsoi, E. J., Chang'ach, J. K., & Sang, H. C. (2012). Challenges Facing Adoption of Information Communication Technology (ICT) In Educational Management in Schools in Kenya. *Journal of Sociological Research* , 18-28.

Magana-Flowers. (2011). *Floriculture Operations*. Retrieved August 2, 2014, from Magana Flowers: <http://www.maganaflowers.com/operations.php>

Maoz, A. (2006). *Information and Communication Technologies (ICT) Adoption as a Tool for Agricultural Research Coordination and Information Dissemination*.

Marianna, S. (2003). The information and communication technologies productivity impact. *International Journal of Operations & Production Management* , 23 (10), 1224 - 1245.

Martsynovska, O. (2011). *Global floriculture industry value chain: position of the ukrainian farms in the floriculture business*.

Maumbe, B. M., & Okello, J. (2010). Uses of Information and Communication Technology (ICT) in Agriculture and Rural Development in Sub-Saharan Africa: Experiences from South Africa and Kenya. *International Journal of ICT Research and Development in Africa (IJICRDA)* , 1-22.

- Mojtahed, R., Miguel, B. N., & Guo, C. P. (2011). The role of the technology Acceptance Model: Proceedings of the IADIS International Workshop on Information Systems Research Trends, Approaches and Methodologies. New York: Universities of Leeds.
- Mugenda, O. and Mugenda, A. (1999). Research methods: Qualitative and Quantitative Approaches, Nairobi: Acts Press.
- Qian, J. (2013, April 23). Pilot program uses QR codes to track melons. *Global Times*, p. 7.
- Rikken, M. (2010). *The European Market for Fair and Sustainable Flowers and Plants*. Brussels : Proverde.
- Rikken, M. (2011). The Global Competitiveness of the Kenyan Flower Industry. *5th Video Conference on the Global Competitiveness of the Flower industry in East Africa*. World Bank Group and Kenya Flower Council.
- Rogers, E. M. (1995). *Diffusion of Innovations*. The Free Press.
- Schindler, P. (2000). *Business Research Methods*. New York: McGraw Hill.
- Sergeant, A. (2004). *Horticultural and Floricultural Exports-Constraints, Potential and an Agenda for Support Tanzania Diagnostic Trade Integration Study*. World Bank.
- Silva, H. d., & Ratnadiwakara, D. (2010). ICT Policy for Agriculture Based on a Transaction Cost Approach: Some Lessons from Sri Lanka. *International Journal of ICT Research and Development in Africa (IJICTRDA)*, 14.
- Syed, S. A. (2009). ICT Adoption in Small and Medium Enterprises:an Empirical Evidence of Service Sectors in Malaysia. *International Journal of Business Managememt*, 112.
- Taragola, N., & Gelb, E. (2011). *Information and Communication Technology (ICT) Adoption in Horticulture: A Comparison to the EFITA Baseline*. Brussels.
- World-Bank-Group. (2012). *Research & Impact-e-Transform Reports: ICTs in relation to Climate Change and Agriculture*. World Bank Group.

World-Bank-Group. (2011). *The global competitiveness of the kenyan flower industry.*

## **APPENDIX 1: QUESTIONNAIRE**

This questionnaire is part of a research being carried out by **Patrick Mathenge**, an MBA student at the University of Nairobi. The study aims to establish the **Extent, Drivers and Challenges of ICT Adoption among Floricultural Farms in Kenya.**

### **NOTES**

- i. Kindly answer all questions as required to the best of your knowledge.
- ii. Do not indicate your name in any part of this questionnaire.
- iii. The information provided will not be disclosed to any unauthorized parties.
- iv. This research is for academic purposes but the general sector results could be shared with interested stakeholders upon such as request being done in writing.

### **SECTION A- FARM DEMOGRAPHICS**

*(Please tick appropriately)*

1. Gender: Male  Female
  
2. Age : Under 20 years  20-25years  26-30years  31-35years   
36-40years  41-45years  46-50years  >50 years
  
3. How long have you worked in this farm?  
Less than 1 year  1-5 years  6-10 years  11-15 years   
16-20 years  > 20 years
  
4. How old is your farm? 1-5 years  6-10 years  11-15 years   
16-20 years  > 20 years
  
5. How many employees does your farm has? < 10  11-25  26-50   
51-75  76-100  101-125  126-150  151-175   
176-200  > 200

6. What is your farm's annual revenue in Kenya shillings? < 1,000,000 [ ]  
 1,000,000-5,000,000 [ ] 6,000,000-10,000,000 [ ] 11,000,000-15,000,000 [ ]  
 16,000,000-20,000,000 [ ] 21,000,000-25,000,000 [ ] 26,000,000-30,000,000 [ ]  
 31,000,000-35,000,000 [ ] 36,000,000-40,000,000 [ ] 41,000,000-45,000,000 [ ]  
 46,000,000-50,000,000 [ ] > 50,000,000 [ ]

## **SECTION B-EXTENT OF ICT ADOPTION**

*(Please tick appropriately)*

1. Please rate, in your own evaluation, the level of computerization in your farm.  
 0-20% [ ] 21-40% [ ] 41-70% [ ] Over 70% [ ]
2. Please rate, in your own evaluation, the percentage of operations that are interrelated through computerization.  
 0-20% [ ] 21-40% [ ] 41-70% [ ] Over 70% [ ]
3. What percentage of your entire farm budget is allocated to ICT?  
 0-2% [ ] 3-5% [ ] 6-8% [ ] Over 10% [ ] No Idea [ ]

To what extent are the following ICT applications adopted in your farm? *(Please circle appropriately)*

	No extent	Little extent	Moderate extent	Great extent	Very great extent
1. Internet and emails	1	2	3	4	5
2. Office, procurement and accounting automation systems such as sage pastel, dansoft, Dynamics navision	1	2	3	4	5
3. Computerized planting systems e.g teff planting machine	1	2	3	4	5

4. computer storage and servers	1	2	3	4	5
5. Computerized irrigation and fertigation systems					
6. Field operations applications e.g Scarab for pest and disease monitoring	1	2	3	4	5
7. Automated packing systems	1	2	3	4	5
8. Computerized storage and refrigeration systems					
9. Any other (Please specify and rate accordingly)	1	2	3	4	5

### SECTION C-DRIVERS OF ICT ADOPTION

Please indicate the extent to which each of the following were drivers for adoption of ICT in your farm. (*Please circle appropriately*)

	No extent	Little extent	Moderate extent	Great extent	Very great extent
<b>Economic Drivers</b>					
1. Cost of ICT deployment	1	2	3	4	5
2. Cost saving	1	2	3	4	5
3. Desire to increase revenues	1	2	3	4	5
4. Any other (Please specify and rate accordingly)	1	2	3	4	5
<b>Functional Factors</b>					

5. Operations streamlining	1	2	3	4	5
6. Operations speed	1	2	3	4	5
7. Operations interdependence	1	2	3	4	5
8. Any other (Please specify and rate accordingly)	1	2	3	4	5
<b>Technical Drivers</b>					
9. Simplicity in use of the ICT tools and systems	1	2	3	4	5
10. Security of the ICT tools and systems	1	2	3	4	5
11. Scalability of the ICT tools and systems	1	2	3	4	5
12. Availability/uptime of the ICT systems	1	2	3	4	5
13. Performance of the ICT tools and systems	1	2	3	4	5
14. Flexibility of the ICT tools and systems	1	2	3	4	5
15. Any other(Please specify and rate accordingly)	1	2	3	4	5
<b>Strategic Drivers</b>					
16. Cost reduction	1	2	3	4	5
17. Focus on core competences	1	2	3	4	5
18. Inter-farms collaboration					
19. Transformation of operations	1	2	3	4	5
20. Availability/uptime of the ICT systems	1	2	3	4	5
21. Diversification	1	2	3	4	5
22. Any other(Please specify and rate	1	2	3	4	5

accordingly)					
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## SECTION D-CHALLENGES OF ICT ADOPTION

Please indicate the extent to which the farm has faced each of the following challenges in ICT adoption in your farm. (*Please circle appropriately*)

	No extent	Little extent	Moderate extent	Great extent	Very great extent
1. Fear of loss of data/information confidentiality	1	2	3	4	5
2. Fear of loss of data/information control	1	2	3	4	5
3. Lack of a clear ICT strategy	1	2	3	4	5
4. Insufficient internet connectivity and bandwidth	1	2	3	4	5
5. Impact on operations	1	2	3	4	5
6. Lack of security and proper Service Agreement Levels (SLAs)	1	2	3	4	5
7. Lock ins to ICT infrastructure and service vendors	1	2	3	4	5
8. Inability to quantify ICT benefits	1	2	3	4	5
9. Culture of the farm	1	2	3	4	5
10. Maturity level of the farm	1	2	3	4	5
11. Technical capability of the staff members	1	2	3	4	5

12. Fear of overdependence on ICT	1	2	3	4	5
13. Cost of ICT tools deployment	1	2	3	4	5
14. Fear of dealing with viruses, trojans, malware, phishing etc	1	2	3	4	5
15. Unpopularity among workers over loss of jobs	1	2	3	4	5
16. Any other(Please specify and rate accordingly)	1	2	3	4	5